

INVESTIGATING THE EFFECTS OF TEMPERATURE INVERSIONS ON AIRWAY DISEASE USING AIRS

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BACKGROUND

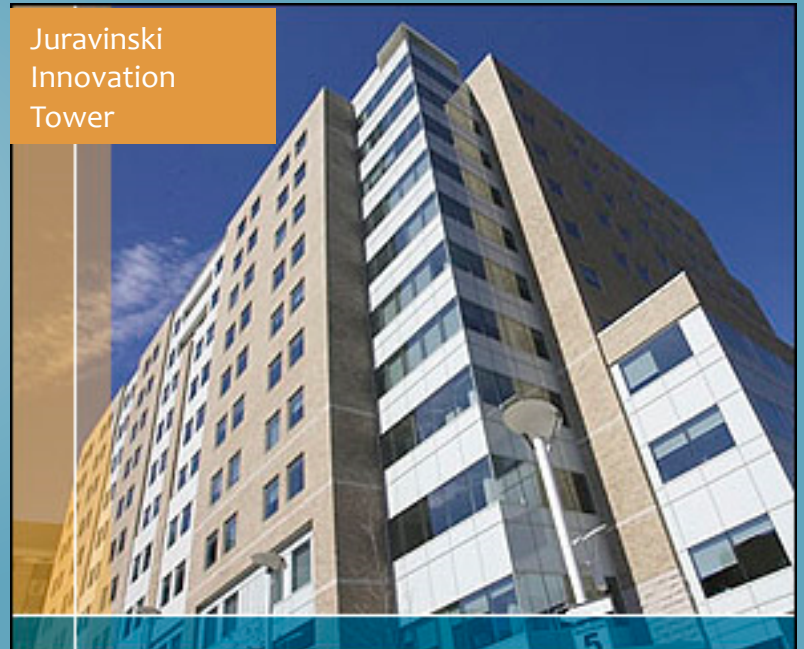


- *Previous study on bronchitis and proximity to roads*
- *Separate study on effect of temperature inversions on air pollution*

FIRESTONE INSTITUTE OF RESPIRATORY HEALTH

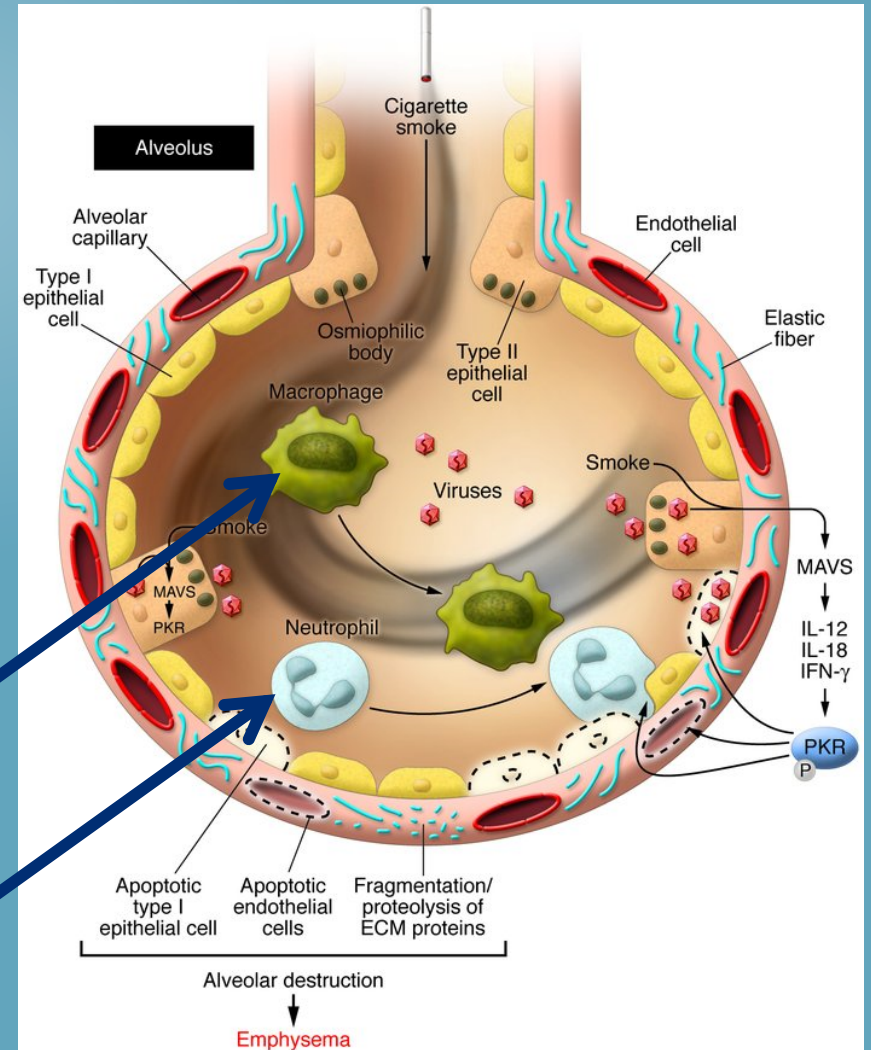
- *Bronchitis quantitatively defined by proportion of various types of white blood cells*
- *Sputum samples from patients*
- *Cell counts*
 - *Type of airway disease (bronchitis)*
 - *Severity of airway disease*

Juravinski
Innovation
Tower



CELL TYPES

- Neutrophils and Macrophages
- White blood cells
- First line of defense against infection
- Respond quickly



It takes two to tango: cigarette smoke partners with viruses to promote emphysema, Rubin M. Tudor, Jeong H. Yun, J. Clin. Invest. 2008; 118(8):2689

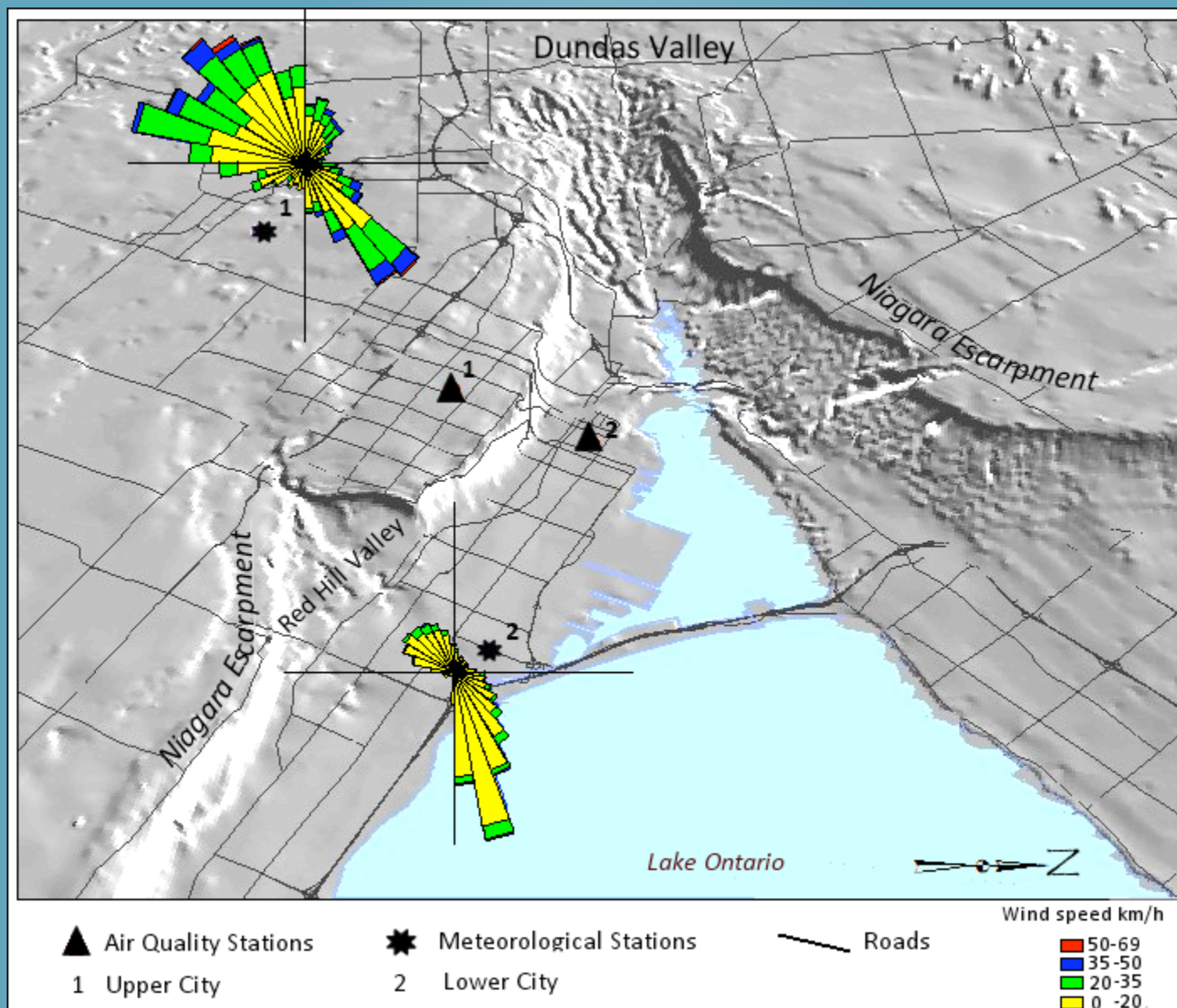
STUDIES

- *A few studies suggesting that air pollution caused an increase in neutrophil cells in the airways*
 - Nobutomo, K., 1978. Air pollution and cytological changes in sputum. *Lancet* 1: 523-526.
 - Dragonieri, S., Musti, M., Izzo, C., Esposito, L.M., Barbaro, M.P.F., Resta, O., Spanevello, A., 2006. Sputum induced cellularity in a group of traffic policemen. *Sci Total Environ* 367: 433-436.
 - Wardlaw, A.J., Silverman, M., Siva, R., Pavrod, I.D., Green, R., 2005. Multi-dimensional phenotyping: toward a new taxonomy for airway disease. *Clinical and Experimental Allergy* 35: 1254:1262.
 - Bosson, J., Pourazar, J., Forsberg, B., Adelroth, E., Sandström, T., Blomberg, A., 2008. Diesel exhaust exposure enhances the ozone-induced airway inflammation in healthy humans. *Eur Respir J* 31: 1234-1240.

TEMPERATURE INVERSIONS

- *Influenced by Niagara Escarpment*
- *Proximity to Great Lakes*

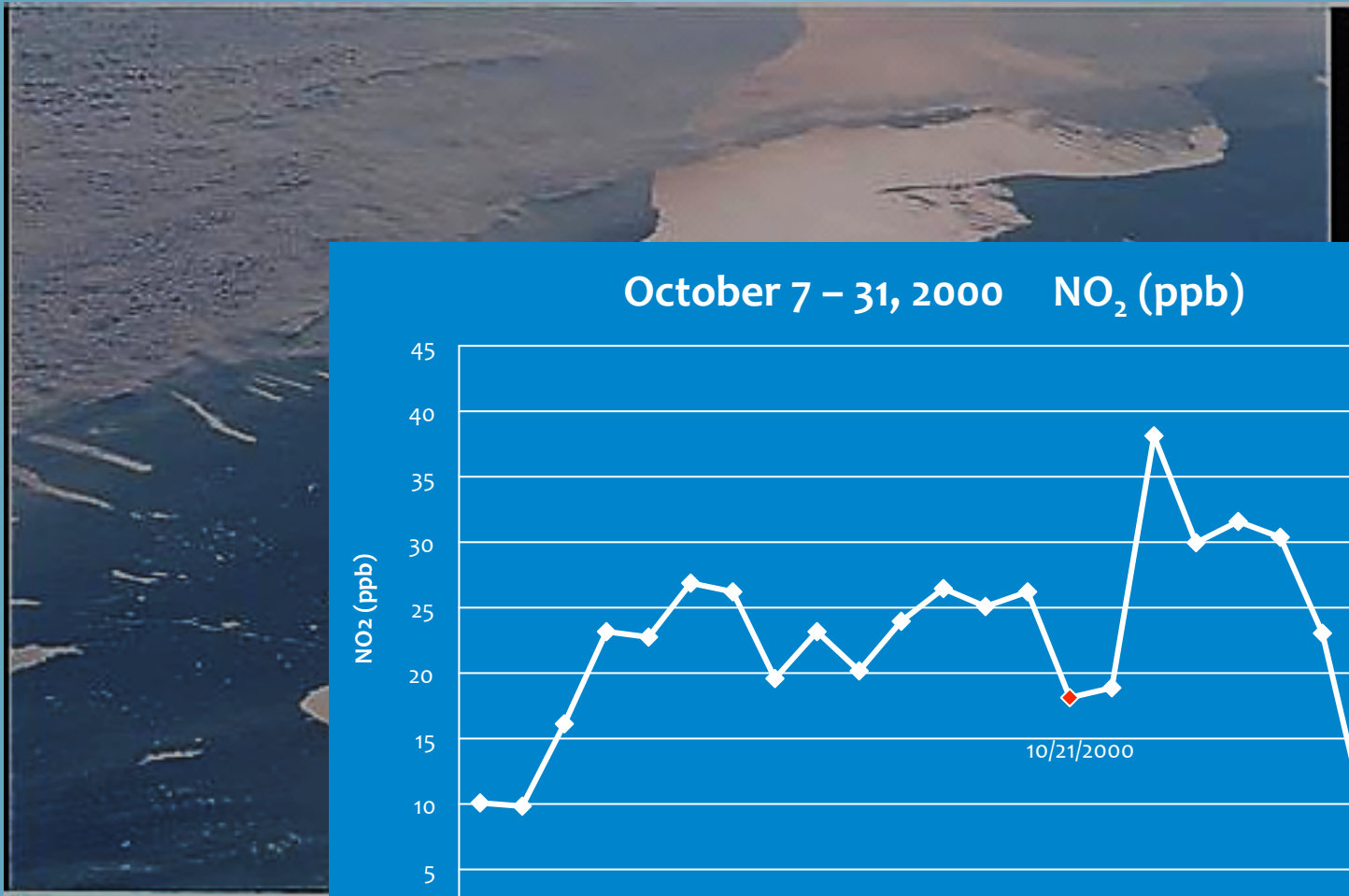




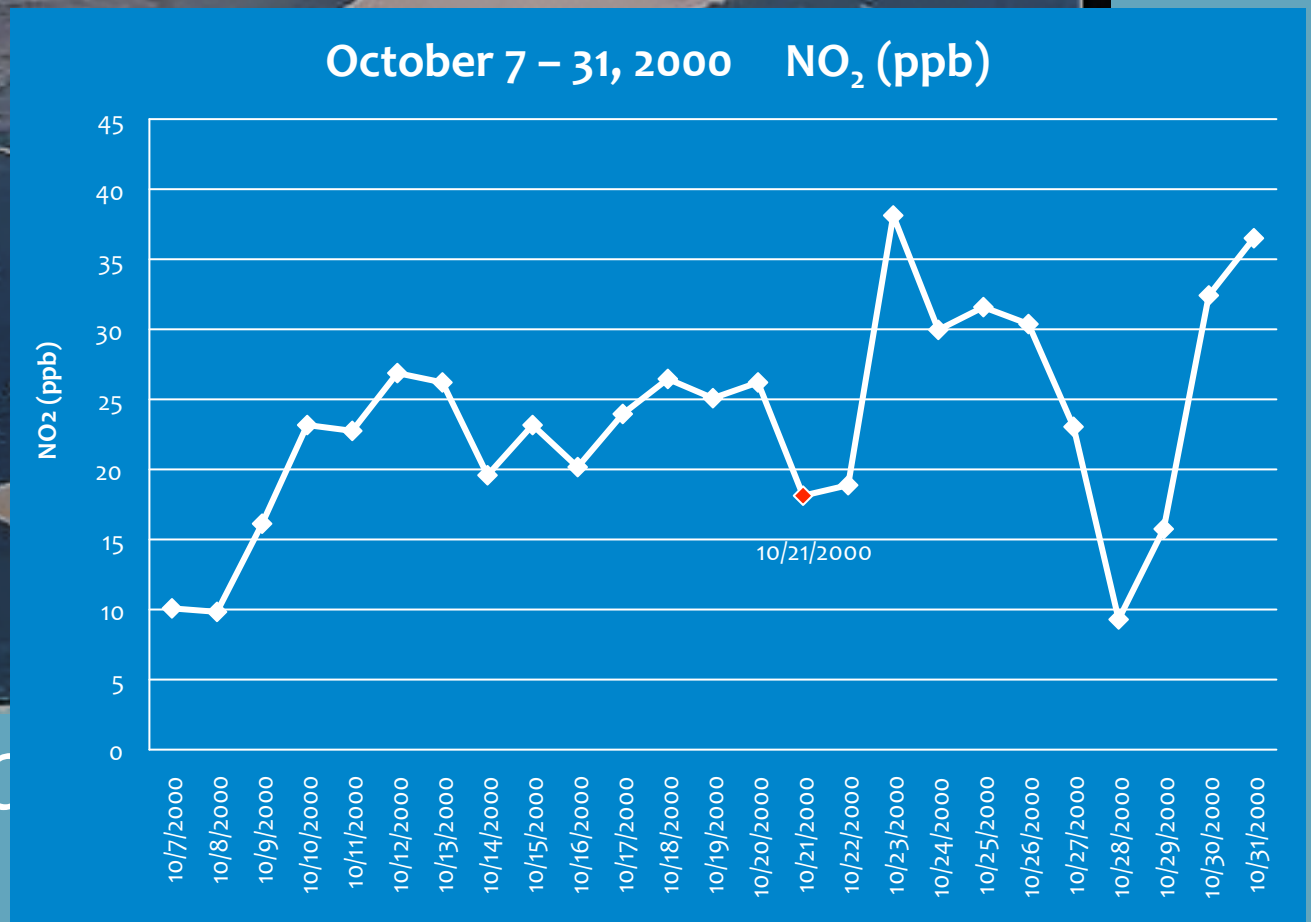
TEMPERATURE INVERSIONS JUNE 2009



HAZE OVER LAKE ERIE

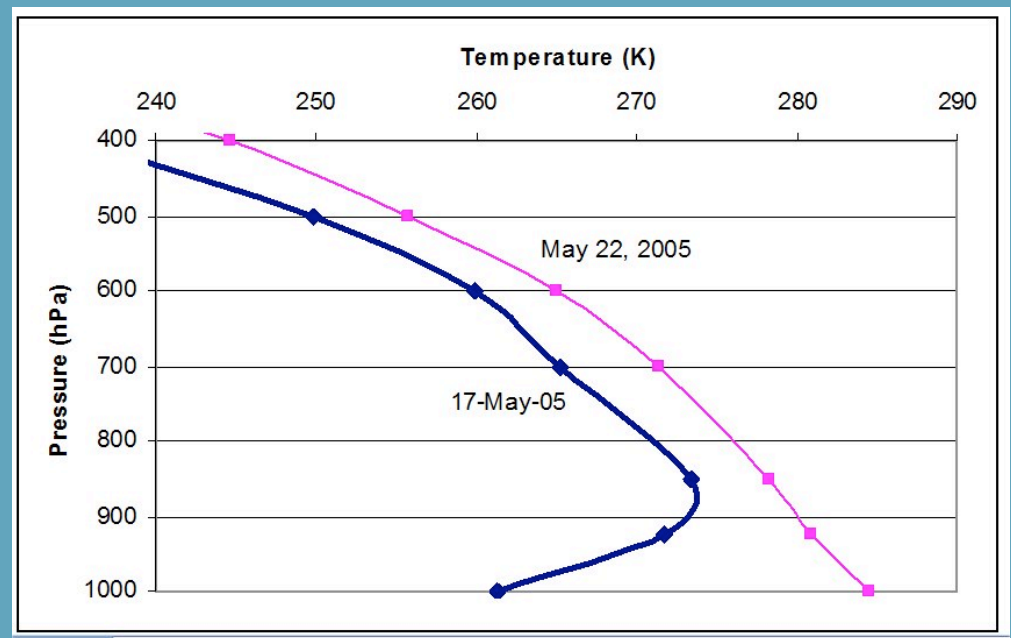


STS092 C

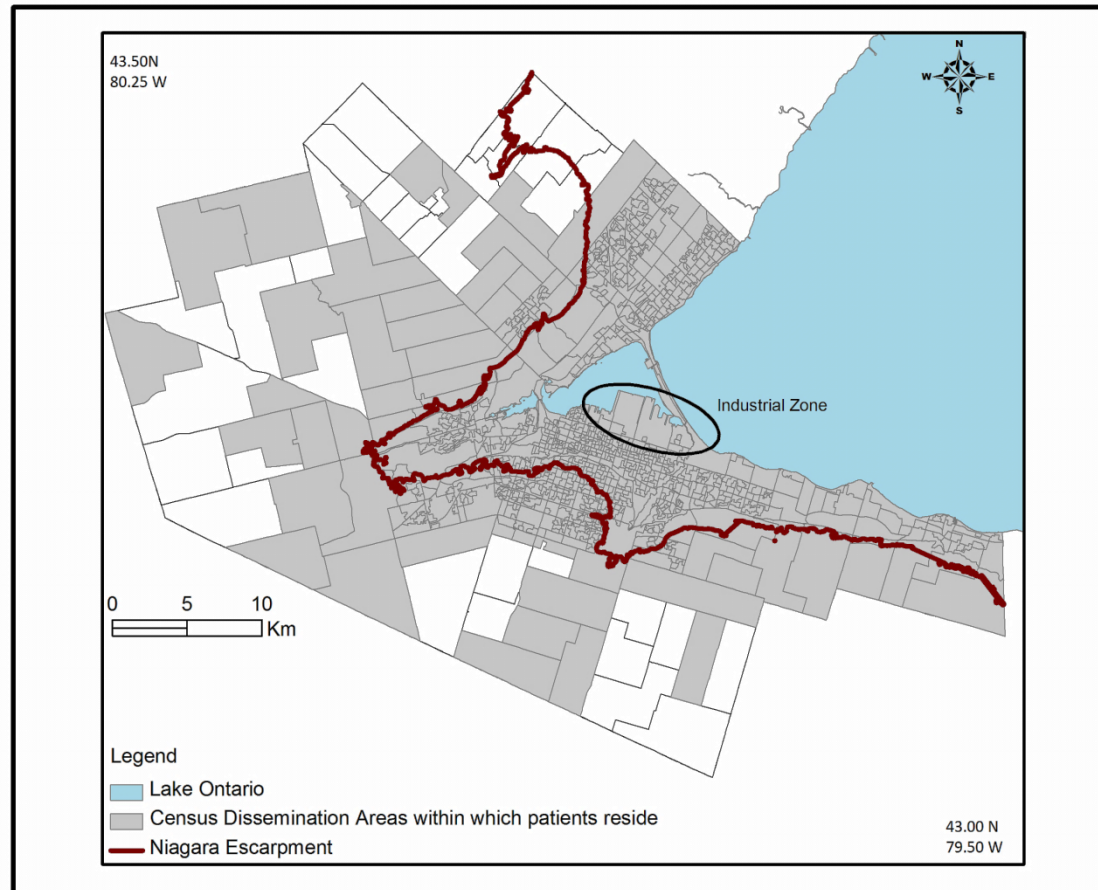


AIRS TEMPERATURE PROFILES

- *Data from GIOVANNI*
- *AIRS Level 3, version 5,*
- *AM/PM temperature profiles*
- *2004-2006*

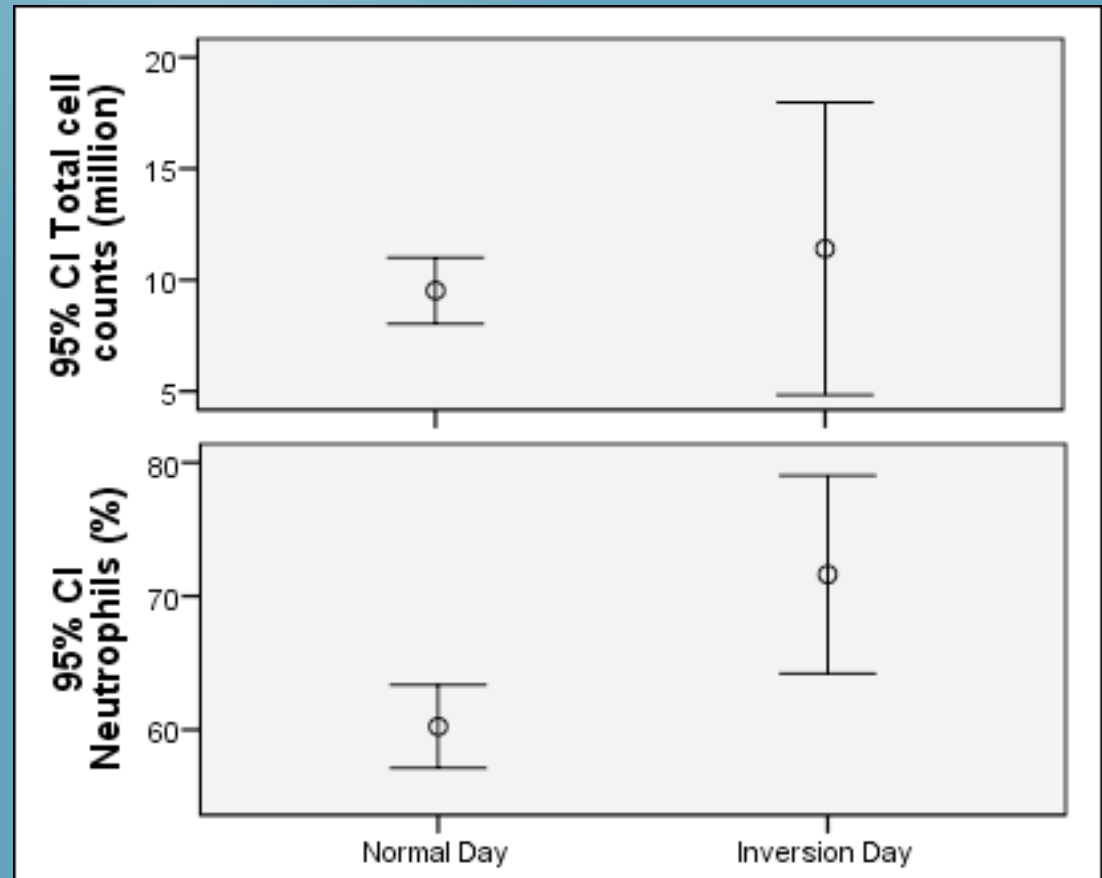


PATIENT LOCATIONS

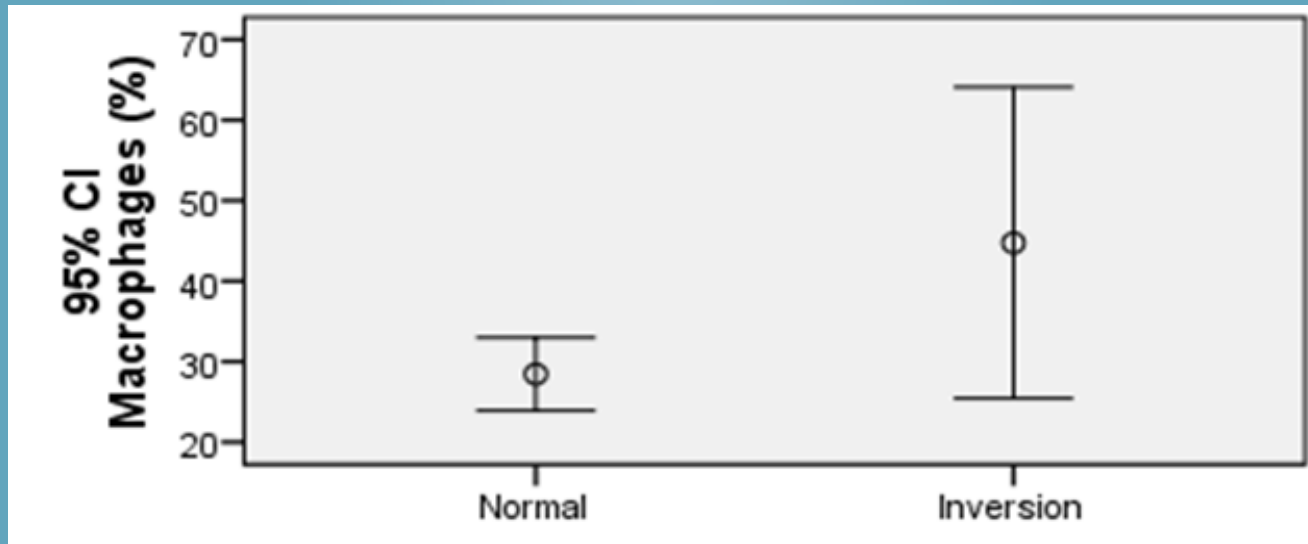


CELL COUNTS - STABLE GROUP

- *Neutrophil % increased*
- *Consistent with other studies*
- *Largest increases in asthma patients*



EXACERBATED GROUP



- *Macrophages increased on inversion days*
- *COPD patients*
- *Different mechanism in the response to air pollution?*

MULTIVARIATE STATISTICAL ANALYSES

- *Controlling for*
 - *Smoking*
 - *Age*
 - *Medication*
 - *Temperature and humidity*
- *Daytime and night-time inversions*

MULTIVARIATE RESULTS

	STABLE	EXACERBATED
Dependent Variable	Neutrophils (%)	Macrophages (%)
Continuous Independent variables	IQR change in percent neutrophil (95%CI)	IQR change in percent macrophage (95%CI)
Age (years)	21.1(16.8,25.5)	-1.6(-2.2,-1.2)
Temperature °C	-0.9(-5.3,3.5)	-1.2(-1.6,1.1)
Relative humidity %	-2.3(-6.4,1.8)	-1.2(-1.5,1.2)
Inhaled corticosteroids (µg/day)	1.0(-2.0,4.0)	0(0,0)
Categorical Independent Variables	Change in percent neutrophil (95%CI)	Change in percent macrophage (95%CI)
Smoker versus non-smoker	-1.0(-7.0,4.9)	1.7(1.1,2.7)
Same day inversion versus normal day (AIRS)	12.6 (3.9,21.4)	2.5 (1.3,4.8)

CONCLUSIONS

- *Cellular response to temperature inversions identified*
 - *Increased air pollution*
 - *Increased allergens*
 - *Combination*
- *Mechanism may be different for patients who are stable and exacerbated*
- *Response occurs in short-term (within hours)*
- *Interesting – the associations of spatial scales from regional/global to cellular*

IMPLICATIONS

- *Current environmental conditions not previously considered*
- *Could not always explain increases in cell counts in stable patients*
- *Re-think patient diagnoses*
- *Occurrence of temperature inversions should be added to air quality forecasts and Air Quality Health Indices*